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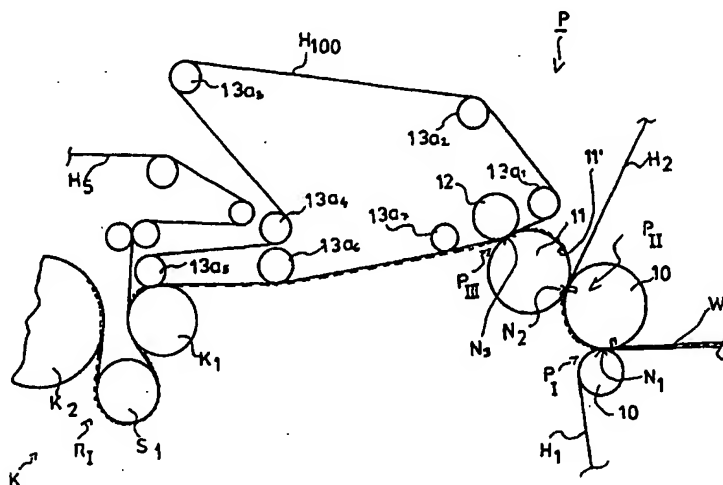
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>D21F 7/00</b>		A1	(11) International Publication Number: <b>WO 98/45534</b>
			(43) International Publication Date: 15 October 1998 (15.10.98)
(21) International Application Number: PCT/FI98/00288		(81) Designated States: BR, CA, CN, JP, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) International Filing Date: 1 April 1998 (01.04.98)			
(30) Priority Data: 971399 4 April 1997 (04.04.97) FI		Published With international search report. In English translation (filed in Finnish).	
(71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Panuntie 6, FIN-00620 Helsinki (FI).			
(72) Inventors; and (75) Inventors/Applicants (for US only): LINSURI, Ari [FI/FI]; Vuorentie 2, FIN-40950 Muurame (FI). KOMULAINEN, Antti [FI/FI]; Tarhiantie 22, FIN-42700 Keuruu (FI).			
(74) Agent: FORSSÉN & SALOMAA OY; Yrjönkatu 30, FIN-00100 Helsinki (FI).			

(54) Title: METHOD AND EQUIPMENT IN THE TRANSFER OF A WEB FROM THE PRESS SECTION OF A PAPER/BOARD MACHINE TO THE DRYER SECTION



(57) Abstract

The invention relates to a method and apparatus in the transfer of a web (W) from a press section (P) to a dryer section (K) in a paper machine/board machine. In the method, the web (W) is passed in the press section through one or more dewatering press nips (N<sub>1</sub>, N<sub>2</sub>...) thereof. The web (W) is transferred as a closed draw from the last press (P<sub>III</sub>; P<sub>IV</sub>) of the press section (P) to the dryer section (K). A transfer belt (H<sub>100</sub>; H<sub>200</sub>; H<sub>300</sub>) is employed in the transfer of the web (W). In that connection, in the last press (P<sub>III</sub>; P<sub>IV</sub>) before the dryer section (K), the web (W) is transferred from a smooth roll of the press directly onto the face of the transfer belt (H<sub>100</sub>; H<sub>200</sub>; H<sub>300</sub>). In this connection, while adhering to the face of the transfer belt (H<sub>100</sub>; H<sub>200</sub>; H<sub>300</sub>), the web (W) is transferred as a closed draw from the press section (P) to the dryer section (K) favourably without any separate blowings or other auxiliary means.

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METHOD AND EQUIPMENT IN THE TRANSFER OF A WEB FROM THE PRESS SECTION OF A PAPER/BOARD MACHINE TO THE DRYER SECTION

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The invention relates to a press section of a paper machine or a board machine which comprises several successive press zones, a paper web being transferred as a closed draw to the first press zone of said zones from a forming wire of the paper machine, the paper web to be pressed being transferred as a supported and closed draw between the different zones of said press section, and the paper web being transferred as a closed draw after the last press zone of said press zones by means of a special transfer belt to a dryer section of the paper machine.

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With regard to the prior art, we refer to the following publications: *US-4483745*, *FI-(B)-81854*, *FI-916026*, *US-5178732* and *FI-905798*. A transfer belt that is preferably of the type described, for example, in *US Patent 5,298,124* is used in the transfer of the web (W) in the application in accordance with our invention.

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Dewatering by means of pressing is in terms of energy economy preferable to dewatering by evaporation. For this reason, attempts should be made to remove a maximum proportion of water from a paper web by pressing in order that the proportion of the water amount that must be removed by evaporation might be made as low as possible. The increased speeds of paper and board machines, however, present new, so far unsolved problems expressly in the dewatering that takes place by pressing, because the press impulse cannot be increased sufficiently by the means known in prior art, above all because, at high speeds, the nip times remain unduly short and, on the other hand, the peak pressure of compression cannot be increased beyond a certain limit without destroying the structure of the web. On some paper grades, high linear loads of the press also have an adverse effect on the quality of paper.

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Further drawbacks of the prior-art wire and press sections include the requirement of suction energy of the suction rolls commonly employed in them as well as the noise problems arising from the suction rolls. Furthermore, the suction rolls with their perforated mantles, internal suction boxes, wearing seals and other suction systems are components that are expensive and require repeated servicing and consume a lot of energy.

A significant drawback of the press felts used in prior-art press sections is the effect of rewetting of the web and a tendency to be contaminated because, especially in the case where said press felts pass through a high-pressure nip or nips, dirt particles tend to adhere and stick to the press fabrics, and therefore the operation of the press fabrics is disturbed, and to keep them clean requires efficient conditioning devices, which consume a considerable amount of energy.

Moreover, in high-pressure press nips, prior-art porous press felts are subjected to intensive wear and stress so that the felts have to be replaced relatively often, which causes a considerable increase in costs.

With a view to avoiding the above-mentioned problems, the method in accordance with the invention is mainly characterized in that a web W is caused to adhere to the outer face of a substantially water-non-receiving transfer belt and transferred from a press directly to a dryer section, and that the web is passed on the face of the transfer belt into connection with a wire and/or a roll in the dryer section, in which connection the transfer of the web W takes place as a closed draw.

The press section in accordance with the invention includes a transfer belt loop which is substantially water non-receiving and has an outer face capable of adhesion to the paper web.

The transfer belt in accordance with the invention withstands better also intensive cleaning, for example, by high-pressure water jets or doctors.

The method and the apparatus concept in accordance with the invention make it possible for the surfaces of the paper or board that is being manufactured to achieve smoothness properties which are better than before, which is based, for its part, on the use of a relatively smooth-faced transfer belt applied and arranged in accordance with the invention at a suitable process stage.

The method and the apparatus arrangement in accordance with the invention are characterized by what is stated in the claims.

10 In the following, the invention will be described in detail with reference to some embodiment examples illustrated in the figures of the accompanying drawing, to the details of which the invention is, however, by no means narrowly confined.

Fig. 1 shows a first advantageous embodiment of the invention in which a transfer belt is used in connection with a third press for transferring a web from a smooth roll of the press on the face of the transfer belt directly to a first drying group of a dryer section. Pressing the transfer belt by means of a roll against the smooth roll ensures the transfer of the web onto the face of the transfer belt.

20 Fig. 2 shows an embodiment of the invention which corresponds to the embodiment of Fig. 1 in other respects but which, before first, second and third presses of a press section, comprises a separate pre-press in front of the first press. The transfer of the web on the face of the transfer belt, while it adheres to the lower side of the transfer belt, also takes place in this embodiment from a smooth centre roll of the press directly onto a first roll in a dryer section, which roll in the embodiment of the figure is a smaller-diameter drying cylinder.

Fig. 3 shows an embodiment of the invention in which the web is passed in a press section in a conventional way out of connection with first, second and third presses to a fourth press, into whose connection a transfer belt in accordance with the invention is passed, the transfer belt being placed into connection with a smooth upper roll of the fourth press such that the web is transferred in connection with the

upper roll of the fourth press onto the transfer belt and with it directly into connection with of a dryer section. In this embodiment, the wrap angle and tension of the belt against the smooth roll facilitate the transfer of the web W onto the transfer belt.

- 5 Fig. 4 shows an embodiment in which the web is passed from a wire  $H_{10}$  into connection with a so-called pick-up felt.

Fig. 1 shows a first advantageous embodiment of the invention in which a transfer belt  $H_{100}$  has replaced a conventional transfer fabric, such as, a wire and a felt. It is fitted in connection with a third press  $P_{III}$  of a press section P in a paper machine/board machine.

A significant drawback of the press felts employed in prior-art press sections is the effect of rewetting of the web and a tendency to be contaminated. The transfer belt  $H_{100}$  and  $H_{200}$  (Fig. 3) in accordance with the invention is substantially water non-receiving, impervious to air, smooth and, in its outer face, capable of adhering to a paper web. This means that the paper web can be caused to adhere to the outer face of a transfer belt loop without rewetting of the web. On the transfer belt, the web (a paper web or a board web) can be passed as a closed and supported draw forwards to a dryer section K, to the first drying group  $K_I$  of the dryer section.

In the embodiment shown in Fig. 1, the web W is passed into a nip  $N_1$  between press rolls  $10a_1, 10a_2$  in a first press  $P_I$  of the press section P and further by means of a holding force provided by a suction sector D of the press roll  $10a_1$  into a nip  $N_2$  of a second press  $P_{II}$ , which nip is defined between the press roll  $10a_1$  and a centre roll 11. The web W is transferred forwards while adhering to the smooth face 11' of the centre roll 11. The centre roll 11 is preferably a roll having a ceramic coating. The web W is thus passed, while transferred by the centre roll 11, into a nip  $N_3$  of the third press  $P_{III}$  of the press P, i.e. to the nip between the centre roll 11 and a press roll 12. In accordance with the invention, instead of a felt, the transfer belt  $H_{100}$  is passed as a closed loop through said nip  $N_3$  and over guide rolls  $13a_1, 13a_2$ , to the face of which transfer belt  $H_{100}$  the web W adheres in the nip  $N_3$

and, while transferred by said transfer belt  $H_{100}$  and adhering to it by means of adhesion and situated on its lower face, the web  $W$  is passed onto a first drying cylinder  $K_1$  in a first drying cylinder group  $R_1$  of the dryer section  $K$ , and further into connection with a wire  $H_5$  of a single-wire draw in the dryer section  $K$  and with it onto a suction roll  $S_1$  of the first drying cylinder group  $R_1$ , and from it meandering in a loop-like fashion onto a second steam-heated drying cylinder  $K_2$  situated above, and forwards in the first drying cylinder group  $R_1$  of the dryer section  $K$ .

A felt draw  $H_1$  and a felt draw  $H_2$  are passed through the nip  $N_1$ . The conventional felt passed through the third press is replaced with the transfer belt  $H_{100}$  in accordance with the invention, which belt serves to transfer the web from the third nip  $N_3$  directly onto the first drying cylinder  $K_1$  of the dryer section. The web is passed from the lower face of the transfer belt  $H_{100}$  onto the face of the smaller-diameter drying cylinder  $K_1$  of the first drying group  $R_1$  of the dryer section  $K$  and along the face of said drying cylinder with a single-wire draw  $H_3$  forwards in the drying cylinder group such that the web  $W$  is transferred with the wire  $H_3$  from the drying cylinder  $K_1$  onto the suction roll  $S_3$  situated below, and travels along the suction roll on the face of the wire  $H_3$  and meandering in a loop-like fashion again onto the larger-diameter drying cylinder  $K_2$  situated above. The suction rolls  $S_1, S_2, \dots$ , over which the web  $W$  travels furthest outside, are preferably suction rolls of the so-called VAC-ROLL type, which comprise a perforation extending through the roll mantle, which perforations open into the roll and, at the other end thereof, into circumferential grooves provided in the face of the roll. A vacuum is produced inside the suction roll, and the vacuum is applied to the grooves through the perforations, thus further providing circumferential holding forces on those runs of the web  $W$ , too, in which the web is situated furthest outside and is thus not between the wire  $H_5$  and the roll face. The drying cylinders  $K_1, K_2, \dots$  are preferably steam-heated drying cylinders. The drying cylinder  $K_1$  may also be replaced with an unheated roll.

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As shown in Fig. 1, when the transfer belt  $H_{100}$  is employed, the use of many expensive auxiliary means, such as, suction boxes, blow boxes and equivalent

necessary in the conventional transfers of the web W employing a felt or a wire is avoided. In the arrangement in accordance with the invention, as described above, the web W thus adheres to the face of the transfer belt H<sub>100</sub> with the aid of the pressing nip N<sub>3</sub> and travels with the transfer belt H<sub>100</sub> from the third press P<sub>III</sub> onto the drying cylinder K<sub>1</sub> of the first drying group R<sub>I</sub> of the dryer section. Consequently, no separate auxiliary means, such as, blow boxes or equivalent are needed. Thus, the web W is transferred as a closed draw from the lower face of the transfer belt H<sub>100</sub> onto the first drying cylinder K<sub>1</sub> of the dryer section K, and the web W is passed forwards on the face of the wire H<sub>5</sub> of the dryer section first onto the suction cylinder S<sub>1</sub> situated below and then meandering in a loop-like fashion onto the second drying cylinder K<sub>2</sub> situated above and forwards in the drying cylinder group R<sub>I</sub>.

Fig. 2 shows an embodiment of the invention which is identical with the embodiment of Fig. 1 in other respects but in said embodiment the web is passed through a so-called pre-press P<sub>E</sub>, preferably a so-called extended-nip press, into a first press P<sub>I</sub> and transferred from the first press P<sub>I</sub> into a second press P<sub>II</sub> situated in connection with a centre roll and further from the second press P<sub>II</sub> into a third press P<sub>III</sub>, through whose nip N<sub>3</sub> is passed a transfer belt H<sub>100</sub> which is impervious to air and possesses a good capability of adhesion to the web W in accordance with the invention. In the arrangement shown in Fig. 2, the web is also passed, while adhering to the face of the transfer belt H<sub>100</sub>, from the nip N<sub>3</sub> of the third press P<sub>III</sub> to the first drying cylinder group R<sub>I</sub> of the dryer section K. By using a pressing transfer nip N<sub>3</sub>, the invention also provides a closed equalizing press arrangement. The nip N<sub>3</sub> can be used for equalizing the unequal-sidedness of the surfaces of the web caused by the preceding nip/nips, in particular single-felted nip/nips.

Fig. 3 shows a third advantageous embodiment of the invention in which so-called free draws, or draws of the web not supported by a transfer fabric, and the resultant problems are avoided by employing a transfer belt H<sub>200</sub> after a fourth press P<sub>IV</sub> of a press section P between the fourth press P<sub>IV</sub> and a dryer section K. As illustrated in Fig. 3, the web W is passed to a first press P<sub>I</sub> of the press section P into a nip N<sub>1</sub>



between press rolls  $10a_1$  and  $10a_2$ , the web is transferred by means of holding suction produced by the upper suction roll  $10a_1$  of the first press  $P_I$  into a nip  $N_2$  of a second press  $P_{II}$  between a centre roll 11 and the press roll  $10a_1$ , and the web  $W$  is further transferred along the centre roll 11, while adhering to its face  $11'$ , to a third press  $P_{III}$  into a nip  $N_3$  between the centre roll 11 and a press roll 12, and further from the third press  $P_{III}$  on the face of the centre roll 11 as a short free draw  $F_1$  onto a guide roll 20. Preferably, the press roll 12 is a so-called extended-nip roll in which a press zone having a length of 100-300 mm is formed by means of a loadable shoe and a resilient mantle.

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The transfer of the web  $W$  forwards from the suction transfer roll 20 takes place with a felt  $H_4$  on the upper face thereof to a fourth press  $P_{IV}$  into a nip  $N_4$  between its press rolls 24, 25. While adhering to the face  $25'$  of the upper roll 25 of the fourth press  $P_{IV}$ , the web  $W$  is transferred along the face of the roll 25 into connection with the transfer belt  $H_{200}$  in accordance with the invention. The transfer belt  $H_{200}$  is guided by guide rolls  $30a_1, 30a_2, \dots$ , of which the guide rolls  $30a_1, 30a_2$  are pressed against the face of the upper press roll 25 of the fourth press  $P_{IV}$  such that the run of the transfer belt  $H_{200}$  may be caused to follow the face of the upper press roll 25 of the fourth press  $P_{IV}$  over a part of its length, i.e. over a certain sector length. In this embodiment, the wrap angle and tension of the belt against the smooth roll facilitate the transfer of the web  $W$  onto the transfer belt. The transfer belt  $H_{200}$  is passed as a closed loop over the guide rolls  $30a_1, 30a_2, \dots$ . The web  $W$  adheres to the face of the transfer belt  $H_{200}$  at the guide roll  $30a_1$  and is transferred with the transfer belt  $H_{200}$  further to the dryer section  $K$ , onto the first roll of its first drying cylinder group  $R_1$ , preferably a so-called transfer suction roll  $T_1$ , and further with a wire  $H_5$  of the first drying group  $R_1$  of the dryer section  $K$  onto a first steam-heated drying cylinder  $K_1$  and further onto a suction roll  $S_1$  of the VAC-ROLL type situated below, and further meandering in a loop-like fashion onto a second drying cylinder  $K_2$  situated above, and forwards in the drying cylinder group  $R_1$ .

- In the construction in accordance with the invention, the suction rolls  $S_1, S_2, \dots$  of the VAC-ROLL type attach the web  $W$  to the face of the suction roll by means of vacuum provided inside the roll. The roll mantle of the suction rolls  $S_1, S_2, \dots$  comprises a perforation in which the holes open into grooves situated in the roll mantle and, at the other end, into the roll. Thus, a circumferential holding force can be applied to the web  $W$  by means of the vacuum introduced into the suction rolls in those runs of the web, too, in which the web  $W$  runs furthest outside and the wire  $H_5$  is against the face of the suction roll  $S_1, S_2$ .
- 5 Felts  $H_1$  and  $H_2$  are passed through the first press  $P_I$  of the press section  $P$  such that the felt  $H_2$  is passed along the face of the upper press roll provided with a suction zone in the first press  $P_I$  to the second press  $P_{II}$ . Similarly, the lower felt  $H_1$  is passed through the nip  $N_1$  of the first press  $P_I$ . In the embodiment of the figure, a felt  $H_3$  is passed through the nip  $N_3$  of the third press  $P_{III}$  and over guide rolls  $13a_1, 13a_2$ . Thus, in the embodiment of Fig. 3, the web  $W$  is transferred from the nip  $N_3$  of the third press  $P_{III}$  along the face  $11'$  of the centre roll 11 onto the transfer suction roll 20 and with the felt  $H_4$  on the upper face thereof to the fourth press  $P_{IV}$  and further, as described above, onto the transfer belt  $H_{200}$  from the upper roll 25 of the fourth press. The felt  $H_4$  is passed through the nip  $N_4$  and over felt-guide rolls  $14a_1, 14a_2$ . The felt-guide roll  $14a_1$  is preferably a so-called transfer suction roll.

- As shown in Fig. 4, the paper or board web  $W$  is passed from a wire  $H_{10}$  into connection with a so-called pick-up felt  $H_{11}$ . A transfer suction roll  $51a_1$  transfers the web  $W$  from the wire  $H_{10}$  into connection with the pick-up felt  $H_{11}$ , the web being transferred between the felt  $H_{11}$  and a lower felt  $H_{12}$  into a nip  $N_{10}$  defined by press rolls  $M_1$  and  $M_2$ , preferably press rolls of an extended nip press, and forwards between the felts  $H_{11}$  and  $H_{12}$  up to a guide roll  $51a_n$  of the wire  $H_{12}$ , and forwards between a felt  $H_{13}$  and the felt  $H_{12}$  up to a guide roll  $52a_n$ , which is placed after the guide rolls  $51a_n$  and  $53a_1$  (seen in the running direction of the web  $W$ ). Beneath the felt draw  $H_{12}$  there is a blow box 120, by means of which the web is held on the face of the felt  $H_{12}$  and guided further between the felts  $H_{13}$  and  $H_{12}$ .

After the guide roll 52a<sub>n</sub>, the web W travels on the lower face of the felt H<sub>13</sub> into a second press nip N<sub>11</sub>, preferably into a nip defined by rolls M<sub>3</sub> and M<sub>4</sub> of an extended nip press. Preferably, both of the nips N<sub>10</sub> and N<sub>11</sub> are nips comprising an extended nip roll and at least one of the above-mentioned nips N<sub>10</sub>, N<sub>11</sub> comprises an extended nip roll. The web W is transferred from the latter nip N<sub>11</sub> along the face M<sub>4</sub>' of the smooth lower roll M<sub>4</sub>, while adhering to said face, into connection with a transfer belt H<sub>300</sub>, which is passed over guide rolls 54a<sub>1</sub>, 54a<sub>2</sub>, 54a<sub>3</sub>. The guide roll 54a<sub>1</sub> is fitted with respect to the smooth-faced lower roll M<sub>4</sub> such that the transfer belt H<sub>300</sub> is pressed against the face M<sub>4</sub>' of the smooth lower roll M<sub>4</sub>. The web W is picked up from the face of said roll M<sub>4</sub> onto the transfer belt H<sub>300</sub> and transferred with it to a dryer section K. The first drying cylinder K<sub>1</sub> in the first cylinder group R<sub>1</sub> of the dryer section K may be heated or unheated. It is in contact with the face of the transfer belt H<sub>300</sub>, the web W being transferred from the face of the transfer belt H<sub>300</sub> into connection with the smooth-faced drying cylinder K<sub>1</sub> of the dryer section K and forwards in the drying cylinder group preferably comprising a single-wire draw H<sub>5</sub>. In connection with the transfer belt H<sub>300</sub> there is provided a steam box 100 or equivalent, by means of which it is possible to affect the properties of the paper/board web W and, thus, its transfer onto the face of the smooth cylinder K<sub>1</sub>. In other respects, the structure of the dryer section K may be of the kind shown in Fig. 1.

## Claims

1. A method in the transfer of a web (W) from a press section (P) to a dryer section (K) in a paper machine/board machine, in which method the web (W) is passed in  
5 the press section through one or more dewatering press nips ( $N_1, N_2 \dots$ ) thereof, characterized in that the web (W) is transferred as a closed draw from the last press ( $P_{III}; P_{IV}$ ) of the press section (P) to the dryer section (K), in which connection a transfer belt ( $H_{100}; H_{200}; H_{300}$ ) is employed in the transfer of the web, in which  
10 connection the web (W) is transferred from the smooth roll of the press directly onto the face of the transfer belt ( $H_{100}; H_{200}; H_{300}$ ) in the last press ( $P_{III}; P_{IV}$ ) before the dryer section (K), and in which connection, while adhering to the face of the transfer belt ( $H_{100}; H_{200}; H_{300}$ ), the web (W) is transferred as a closed draw from the press section (P) to the dryer section (K) favourably without any separate blowings or other auxiliary means.  
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2. A method as claimed in the preceding claim, characterized in that, in the method, the web (W) is transferred to the dryer section (K) by means of a run of the transfer belt ( $H_{100}$ ) which is passed through the press nip ( $N_3$ ).
- 20 3. A method as claimed in claim 2, characterized in that the transfer belt ( $H_{100}$ ) is caused to travel a part of its run on the face of a roll in the last press nip.
4. A method as claimed in any one of the preceding claims, characterized in that the transfer belt ( $H_{100}$ ) passed as an endless loop is arranged to deliver the web (W)  
25 adhering thereto from the lower face of the transfer belt onto a first drying cylinder ( $K_1$ ) of the dryer section (K), to whose smooth face the web (W) adheres and along whose face the web (W) is transferred further onto a suction roll ( $S_1$ ) situated below in a first drying cylinder group ( $R_1$ ) of the dryer section (K) and from the suction roll further with a single-wire draw ( $H_5$ ) of the dryer section onto a drying cylinder  
30 ( $K_2$ ) situated above and forwards meandering in a loop-like fashion in the first drying cylinder group ( $R_1$ ) of the dryer section (K) comprising said single-wire draw ( $H_5$ ).

5. A method as claimed in the preceding claim, **characterized** in that, in the method, the transfer of the web from the transfer belt ( $H_{100}$ ) to the dryer section takes place by means of a suction roll ( $T_1$ ) placed inside the drying wire loop of the first drying cylinder group of the dryer section.

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6. An apparatus in the transfer of a web from a press section (P) to a dryer section (K) in a paper machine/board machine, **characterized** in that, between the dryer section (K) and the last press ( $P_{III}; P_{IV}$ ) of the press section (P), the apparatus comprises a transfer belt ( $H_{100}; H_{200}; H_{300}$ ) which is capable of adhering to the web (W) and impervious to water and air, in which connection, in the press ( $P_{III}; P_{IV}$ ) preceding the dryer section, the web (W) is caused to adhere from the smooth roll of the press directly to the face of the transfer belt ( $H_{100}; H_{200}; H_{300}$ ), in which connection, in the apparatus arrangement, the run of the transfer belt ( $H_{100}; H_{200}; H_{300}$ ) is passed as an endless loop between the last press ( $P_{III}; P_{IV}$ ) of the press section and the dryer section (K).

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7. An apparatus as claimed in claim 6, **characterized** in that there is a press nip ( $N_3; N_4, N_{11}$ ) through which the transfer belt ( $H_{100}; H_{200}; H_{300}$ ) is passed through the nip ( $N_3; N_4, N_{11}$ ).

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8. An apparatus as claimed in the preceding claim, **characterized** in that the web is transferred through the press nip ( $N_4, N_{11}$ ), and that the transfer belt ( $H_{200}; H_{300}$ ) is arranged to be in contact with the face of one ( $25, M_4$ ) of the press rolls defining said press nip, in which connection the web (W) adheres first in the press nip ( $N_4, N_{11}$ ) to the smooth face of said press roll ( $25, M_4$ ) and is transferred with said roll ( $25, M_4$ ) into connection with the transfer belt ( $H_{200}; H_{300}$ ) and with the transfer belt ( $H_{200}; H_{300}$ ) further to the dryer section (K).

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9. An apparatus as claimed in claim 6 or 7, **characterized** in that the apparatus comprises a first press ( $P_I$ ) and press rolls ( $10a_1, 10a$ ) in said first press, and that the apparatus comprises a centre roll (11), in which connection one ( $10a_1$ ) of the press rolls of the first press ( $P_I$ ) defines a press nip ( $N_2$ ) of a second press ( $P_{II}$ ) with the

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centre roll (11), and that in connection with the centre roll (11) there is provided a press roll (12) of a third press ( $P_{III}$ ), in which connection a press nip ( $N_3$ ) is defined between said press roll (12) and the centre roll (11), in which connection the web (W) is first passed into the nip ( $N_1$ ) between the press rolls (10a<sub>1</sub>, 10a) and transferred by means of holding suction provided by a suction sector of the press roll (10a<sub>1</sub>) into the nip ( $N_2$ ) of the second press ( $P_{II}$ ) between the press roll (10a<sub>1</sub>) and the centre roll (11), after which the web (W) adheres to the face (11') of the centre roll (11) and is transferred on it into the nip ( $N_3$ ) of the third press ( $P_{III}$ ) between the press roll (12) and the centre roll (11), and that the transfer belt ( $H_{100}$ ) is passed as a closed loop through the press nip ( $N_3$ ) of the third press ( $P_{III}$ ), in which connection the web (W) adheres to the lower face of the transfer belt ( $H_{100}$ ) in the press nip ( $N_3$ ) and is transferred with the transfer belt ( $H_{100}$ ) to the dryer section (K), to the first drying cylinder group ( $R_1$ ) of the dryer section.

10. An apparatus as claimed in any one of the preceding claims 6, 7 or 9, characterized in that the apparatus comprises a transfer belt ( $H_{100}$ ) guided as an endless loop and arranged to deliver the web (W) adhering thereto from the lower face of the transfer belt onto a first drying cylinder ( $K_1$ ) of the dryer section (K), to the smooth face of which cylinder the web (W) adheres and along which face the web (W) is transferred further onto a suction roll ( $S_1$ ) situated below in the first drying cylinder group ( $R_1$ ) of the dryer section (K) and from the suction roll further with a single-wire draw ( $H_5$ ) of the dryer section onto a drying cylinder ( $K_2$ ) situated above and forwards meandering in a loop-like fashion in the first drying cylinder group ( $R_1$ ) in the dryer section (K) comprising said single-wire draw ( $H_5$ ).

11. An apparatus as claimed in the preceding claim, characterized in that the web (W) transferred by means of the transfer belt ( $H_{100}$ ) is removed from the transfer belt ( $H_{100}$ ) by means of a suction roll ( $T_1$ ) placed inside the drying wire loop ( $H_5$ ) in the dryer section.

12. An apparatus as claimed in any one of the preceding claims 6, 7, 9 or 10, characterized in that the first drying cylinder group ( $R_1$ ) of the dryer section (K)

comprises, as the first drying cylinder, a smaller-diameter drying cylinder ( $K_1$ ), to whose face the web (W) adheres in the nip between the transfer belt ( $H_{100}$ ) and said drying cylinder ( $K_1$ ), and along the face of which drying cylinder ( $K_1$ ) the web (W) is transferred forwards in the drying cylinder group ( $R_1$ ) of the dryer section (K) comprising the single-wire draw ( $H_5$ ).

13. An apparatus as claimed in claim 6, 7 or 8 in the transfer of the web (W) from the press section (P) to the dryer section (K), characterized in that the apparatus comprises a press ( $P_{IV}$ ) before the dryer section (K) and press rolls (24,25) in said press, a press nip ( $N_4$ ) being formed between said rolls, and that the press rolls (24, 25) comprise in connection therewith a transfer belt run ( $H_{200}$ ), in which connection the transfer belt ( $H_{200}$ ) is caused to travel a part of its run along the face of one (25) of the nip rolls, in which connection, in the apparatus arrangement, the web (W) is transferred from the nip ( $N_4$ ) along the face (25') of the press roll (25) into connection with the transfer belt ( $H_{200}$ ), which transfer belt ( $H_{200}$ ) is pressed against the face (25') of the press roll (25) by means of guide rolls ( $30a_1, 30a_2$ ), in which connection the web (W) adheres to the face of the transfer belt ( $H_{200}$ ) and is transferred with the transfer belt ( $H_{200}$ ) further to the dryer section (K).

14. An apparatus as claimed in the preceding claim, characterized in that the apparatus comprises first, second and third presses ( $P_I, P_{II}, P_{III}$ ) before the press ( $P_{IV}$ ), in which connection the web (W) is first passed through the nip ( $N_1$ ) between the press rolls ( $10a_1, 10a_2$ ) of the first press ( $P_I$ ) further to the nip ( $N_2$ ) of the second press ( $P_{II}$ ) between the centre roll (11) and the press roll ( $10a_1$ ) and then along the face (11') of the centre roll (11) into the nip ( $N_3$ ) of the third press ( $P_{III}$ ) between the centre roll (11) and the press roll (12), and that the web (W) is transferred as a free draw ( $F_1$ ) further from the third press ( $P_{III}$ ) over a guide roll (20) onto a transfer belt ( $H_4$ ) and with it into the nip ( $N_4$ ) between the press rolls (24, 25) in the fourth press ( $P_{IV}$ ).

15. An apparatus as claimed in claim 6, 7 or 8, characterized in that the apparatus comprises two successive press nips ( $N_{10}, N_{11}$ ), at least one of them being a nip

comprising an extended-nip roll, and that two felts ( $H_{11}, H_{12}$ ) are passed through the first press nip ( $N_{10}$ ), and that the latter press nip ( $N_{11}$ ) comprises at least one roll which is smooth-faced, and through which nip ( $N_{11}$ ) only one felt ( $H_{13}$ ) is passed, in which connection the web ( $W$ ) is transferred on the face of the felt ( $H_{13}$ ) in the latter nip ( $N_{11}$ ) into connection with the smooth-faced roll ( $M_4$ ) thereof and is caused to adhere to the face ( $M_4'$ ) of said smooth-faced roll ( $M_4$ ) and is transferred further along the face of the roll into connection with a transfer belt ( $H_{300}$ ) placed in contact with the smooth-faced roll ( $M_4$ ) of the nip ( $N_1$ ), and that the web ( $W$ ) is transferred with the transfer belt ( $H_{300}$ ) out of connection with the smooth-faced roll ( $M_4$ ) of the latter nip.

16. An apparatus as claimed in any one of the preceding claims, characterized in that in connection with the transfer belt ( $H_{300}$ ) there is provided a heating unit (100), by means of which thermal energy is transferred to the web.

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17. An apparatus as claimed in the preceding claim, characterized in that before the dryer section there is situated, in connection with the transfer belt ( $H_{300}$ ), a steam box (100) or some other actuating member by means of which the properties and transfer of the web ( $W$ ) can be affected such that the web ( $W$ ) can be transferred from the face of the transfer belt ( $H_{300}$ ) to the dryer section ( $K$ ).

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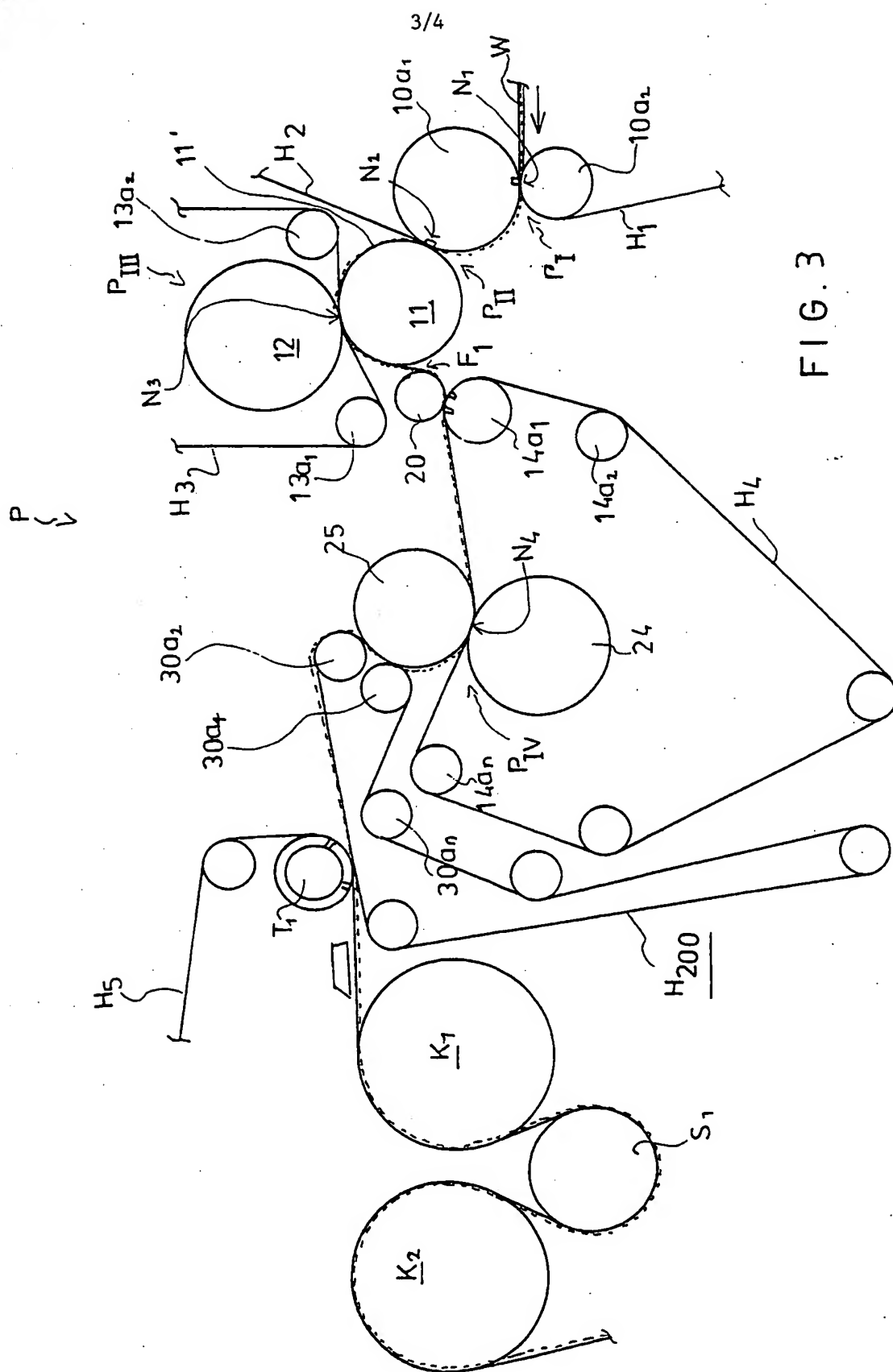
18. An apparatus as claimed in the preceding claim, characterized in that the cylinder ( $K_1$ ) of the dryer section ( $K$ ) is in contact with the face of the transfer belt ( $H_{300}$ ), in which connection the web is transferred from the face of the transfer belt ( $H_{300}$ ) onto the smooth face of the first drying cylinder ( $K_1$ ) or some other roll in the first drying cylinder group ( $R_1$ ) of the dryer section ( $K$ ) and further forwards with the single-wire draw ( $H_5$ ) of the dryer section.

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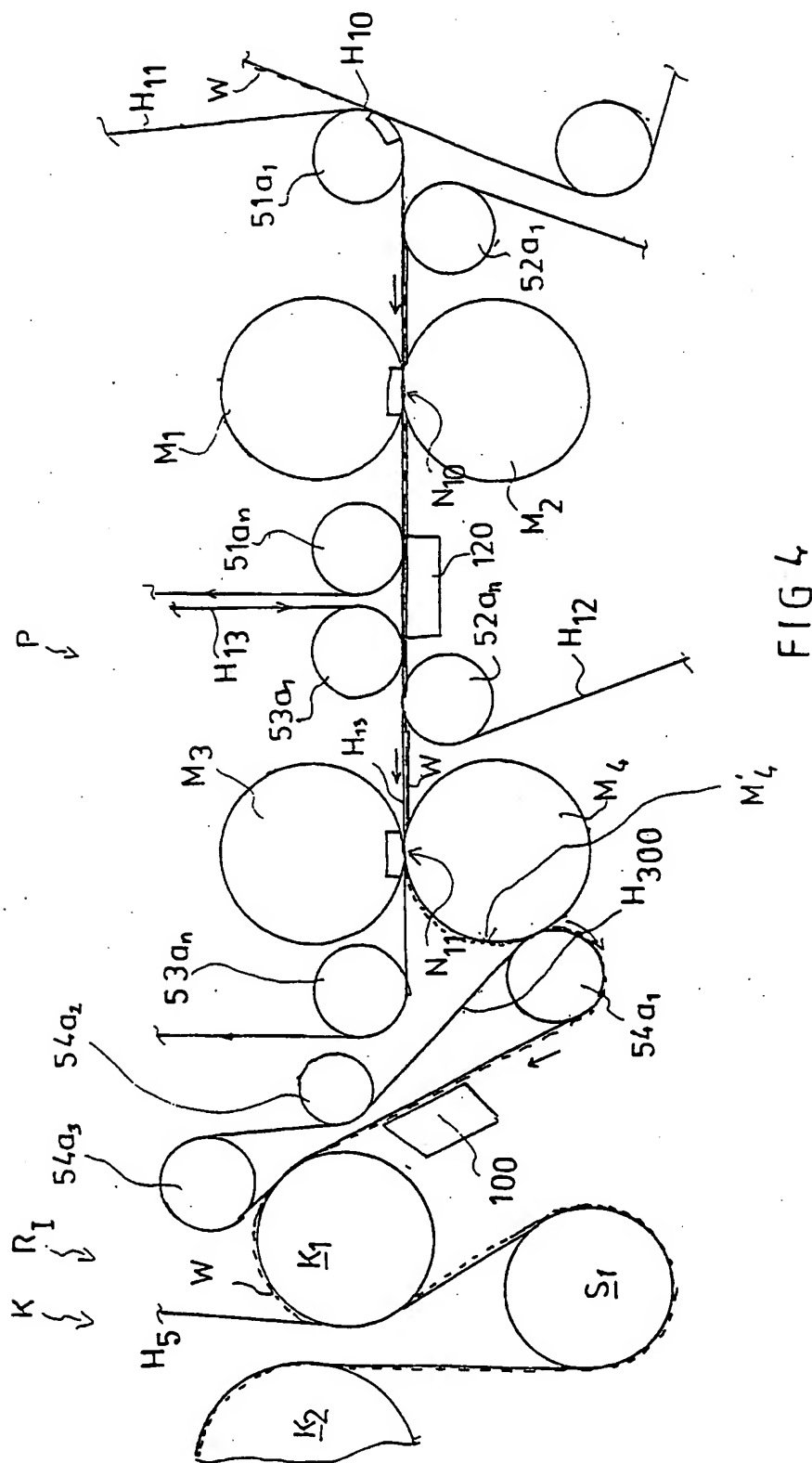


FIG 4

1  
INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00288

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 7/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5534116 A (KARVINEN ET AL), 9 July 1996 (09.07.96), column 8, line 25 - line 43, figures 4-7	1-6
A	-- -----	7-18

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

23 July 1998

Date of mailing of the international search report

23 -07- 1998

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Authorized officer

Olov Jensen

Telephone No. + 46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/FI 98/00288**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5534116 A	09/07/96	AT 136076 T	15/04/96
		CA 2085778 A,C	20/06/93
		DE 69209467 D,T	08/08/96
		EP 0548038 A,B	23/06/93
		SE 0548038 T3	
		FI 916026 A	20/06/93
		US 5240563 A	31/08/93
		US 5393383 A	28/02/95
		US 5611892 A	18/03/97

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